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ABSTRACT

For the past seven years, the Division of Educational Research Services at the University of Alberta has been operating an IBM 1500 CAI system. This paper describes demonstration projects set up in anticipation of the establishment of remote CAI in the North West Territories. These include a moon landing simulation program; a diagnostic program in English as a Second Language; a mathematics drill program; and a program to teach A Programming Language (APL), which is the language of all the CAI programs. The paper concludes with a consideration of the breadth and range of CAI activities that could occur in the N.W.T. in just a few years. (VT)

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Division of Educational Research
University of Alberta

COMPUTER-ASSISTED INSTRUCTION IN THE N.W.T.

by
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J.B. Tyrrell Elementary School
Fort Smith, N.W.T.

RIR-75-2

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

E. W. Romaniuk

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

December 1974

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COMPUTER-ASSISTED INSTRUCTION IN THE N.W.T.

by Tom Garraway.

Time: December, 1974.

Place: J.B. Tyrrell Elementary School, Fort Smith, N.W.T.

Situation: Ten year old students had been studying a unit in Space Science. Such concepts as action and re-action, gravitational force, and Newton's Law of Inertia had been experimented with and examined. Then the children applied these concepts in a detailed look at the Apollo Moon Landing space program. To get a real feel for the problems of controlling the descent of the Lunar Module to the surface of the moon, they took turns at the controls of a computer simulated Lunar Module starting at a point 100 miles above the lunar surface.

Did they have to travel to the Manned Space Flight Centre in Houston, Texas? No! They did not even have to leave their classroom, though the computer controlling the simulation, an IBM 360/67, was 800 miles away on the University of Alberta campus in Edmonton. The students used a remote computer terminal that comes in an aluminum suitcase, weighs 45 pounds, is connected to the computer by telephone, and displays both the computer's output and the student's input on the screen of an ordinary TV set.

During November and December, 1974, students and teachers at J.B. Tyrrell had the opportunity not only to use this moon landing simulation, but also other modes and programs for learning, using one of the newest and most exciting forms of educational technology, computer-assisted instruction or C.A.I. This project was sponsored by the Division of Educational Research Services (DERS) of the Faculty of Education at the University of Alberta, and funded through a grant from IBM.

DERS has been operating an IBM 1500 C.A.I. system for the past seven years. This system is controlled by an IBM 1130 digital computer and handles twenty student terminals. Course information is displayed to the student on a TV type (CRT) screen. The computer can also randomly access up to 1024 still pictures and project them on a screen beside the student, or play prerecorded randomly accessible messages from an audio unit. The student can respond by typing answers on a typewriter-like keyboard or pointing to specified areas on the CRT with a "light pen" connected to the computer.

Much C.A.I. research and course development has been undertaken at the University of Alberta during these seven years. The creation of courses in

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cardiology, physics, French, mathematics, data processing, pharmacology, and nursing, as well as medical patient and industrial simulations are but a few examples. They even have a course that introduces teachers to C.A.I. and prepares them to create and program their own C.A.I. courses.

In a 1974 proposal to the Federal Government the Coordinator of DERS, Dr. S.M. Hunka, stated, "It is our opinion that C.A.I. has passed the drawing board and 'wind tunnel' stages of development, and it is now time that these initial stages be translated into an operational model." (Hunka: p.111). In this proposal, DERS requested $6.9 million from the Federal Government to develop "Canada's first largescale operational C.A.I. system." (Hunka: p.111). The University would contribute over $730,000 to the project. The proposal "details a plan to establish over a five year period, a ..... (C.A.I.) facility located at the University of Alberta, Edmonton, with remote terminals located in Edmonton, Saskatoon, Calgary, Lethbridge and the Northwest Territories." (Hunka: p.vii). The funds would be used for the capitalization of hardware, operational staff support, and the training of instructors from the remote sites. The hardware would include a largescale computing system with two hundred student terminals.

In anticipation of the establishment of remote C.A.I. in the N.W.T. (federal funds forthcoming), DERS decided to undertake a brief C.A.I. demonstration project within the N.W.T. At the time this decision was made, the writer, on education leave from the N.W.T., was a student assistant - C.A.I. programmer with DERS. Since he would soon be taking up a teaching position in Fort Smith, it was decided to operate the project in that community. The Coordinator of C.A.I. Activities for DERS, Dr. E.W. Romaniuk, was appointed director of the project.

The only C.A.I. programs available for remote terminals were on the University's IBM 360/67. These were not as sophisticated as those used on the 1500 system, however.

A demonstration program in English as a Second Language (E.S.L.) was also prepared especially for the project. The program was designed to diagnose a student's ability to comprehend certain English sentence structures, to give remedial help if a weakness was detected, and to inform the teacher which structures gave the student particular difficulty. (Technical Note: All the C.A.I. programs used in this project were written in the computer language APL - A Programming Language - which was developed by a Canadian, Dr. K. Iverson).

The project was approved by the Department of Education of the N.W.T., which provided a telephone extension in the writer's fifth year classroom in J.B. Tyrrell Elementary School for communication with the computer. The terminal was connected

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to a regular telephone hand set through an acoustic coupler. Contact with the computer in Edmonton was made by dialing the computer's telephone number and then signing on to the computer through the terminal's typewriter-like keyboard.

The computer was used as an integral part of the classroom's activities. In addition to the Moon Landing simulation mentioned at the beginning and the E.S.L. diagnostic program, the fifth year students also used a Math drill program. This program presented math problems to a student who was timed by the computer until he answered. If he answered incorrectly, he was given a second chance. If wrong a second time, the computer displayed the answer. The computer based the difficulty level of subsequent questions on the student's past performance. At the end of the drill, the computer presented the student with a summary of his session, including his average time to answer.

A simple spelling drill program was written and entered into the computer from the Fort Smith terminal. It directed the student to select and play a designated audio card on a Bell & Howell "Language Master" set up beside the terminal. The card played a word to the student which he was to type into the computer. The computer then told him if he was correct or, if not, whether his word was too long or too short. It would then redisplay the word inserting blanks for every letter the student misspelled. He could then replay the audio card and try again.

Towards the end of December the students answered an evaluative questionnaire on their attitude to school in general and their classroom situation in particular. To an open-ended sentence that began, "What I like most about my class is .....," almost half of the class spontaniously wrote, "the computer." Some parents commented on the enthusiasm their children showed for the computer activities, and all the students were disappointed when the project ended at Christmas recess.

Another group that participated in the project was a special Math Club formed of twelve senior elementary and junior high school students from the two Fort Smith schools who were interested in learning about computer programming and the problem solving mode of C.A.I. For a few weeks prior to the arrival of the computer terminal, they attended after-school classes in computer programming twice a week. A program on the computer was used to teach them the APL Programming Language. Most of the members wrote computer programs on the IBM 360/67 that related to their school mathematics studies.

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To reduce telephone line charges to Edmonton, the Club often met on Sunday afternoons to work with the computer. When the Grey Cup game was scheduled for telecasting on one Sunday afternoon, the Club members still insisted on holding their regular session.

For one Friday afternoon a demonstration of C.A.I. was presented to the teachers of J.B. Tyrrell Elementary School. The various modes of C.A.I. were discussed. A flow chart of the logic for the E.S.L. diagnostic program was illustrated and explained. Several of the teachers tried out various C.A.I. programs as students, much to the amusement of the observing teachers. For most of the teachers this was their first exposure to C.A.I.

During the project, the computer was used for a total of 30 hours. The total cost of renting time on the University of Alberta's IBM 360/67 was just under $70 or about $2.33 per hour. However, the longdistance telephone charges for the project were almost $1200, or about $40 per hour. At an operating cost of $42.33 per hour, per student terminal, the cost is far too great for anything except such a short term demonstration project as the one described here.

However, the DERS proposal for a large-scale C.A.I. system suggests two alternatives to the handling of each remote terminal via a telephone line:

a) "handling a cluster of terminals via one line," or

b) "having a sufficiently intelligent mini-processor (small computer) capable of executing courseware on a stand alone basis, but with actual course material being communicated at high rate once or twice per day." (Hunka: p.107). Using a cluster of, say, fifteen terminals at a remote site like Fort Smith would bring the communication costs down to approximately $2.67 per terminal per hour. The use of a mini-processor would probably be more advantageous for a larger number of terminals. Communication costs would then be of less concern than the capital cost of the mini-processor.

Let us now use our imagination and look ahead three or four years to a time when DERS has in operation the C.A.I. system of their proposal. (This scenario assumes that the Federal funding has been obtained).

Two or three locations in the N.W.T. will possibly be selected for various levels of remote C.A.I. activity. Because of the number of interested educational institutions, Fort Smith could be one of these locations. In this imaginary situation, the Department of Education has provided space for the remote C.A.I. system in the Teachers' College, as it is central to all the user institutions, and DERS has provided a mini-processor, twenty C.A.I. terminals, and one teletype paper-fed terminal. All maintenance and communication costs would also be paid

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for by DERS.

Now let us look at what might be a typical day at the Fort Smith C.A.I. Centre of the future:

8.30 The Duty Proctor turns on the system and calls the main computer at the DERS C.A.I. Centre. The morning's courseware is transferred at high speed from the main computer to the memory of the mini-processor. Overnight batch jobs of the analysis of the previous day's student performance recordings and an author's request for a listing of a segment of his course are also transferred at high speed for later print-out on the teletype terminal.

9.00 Fifteen students from the Elementary School and five students from the up-grading program of the Adult Vocational Training Centre (A.V.T.C.) arrive to take a remedial math course (see Note 1).

10.00 Second year teacher trainees from the Teacher Education Program (T.E.P.) arrive to continue work on CARE-1 (course 1 of Computer Assisted Remedial Education). This is one of a series of courses in Special Education developed by Pennsylvania State University. CARE-1 trains teachers in the early recognition of educationally handicapping conditions in children and their remediation or referral. This course is a half credit in Educational Psychology at the University of Alberta (see Note 1).

11.00 One of the instructors at the School of Dental Therapy is writing a course on dental physiology (see Note 2.) He has just received a listing of one segment of his course and has brought a group of students over to try it out. He will use the results of their performance, recorded and analysed by the computer, to make revisions to his course.

12.00 The Duty Proctor calls the main computer in Edmonton and transfers the student performance recordings of the morning's courses from the memory of the mini-processor to the main computer. The afternoon's courseware is then transferred in.

1.00 Students from the Secondary School studying Economics in their Social Science program arrive to use simulations of a Lumber Company and a Fishing Industry (see Note 1).

2.00 Students from the Certified Nurses Aid program at A.V.T.C. arrive to take an introductory course in cardiology (see Note 1).

3.00 Twenty students from the Secondary School arrive to take a course that teaches them to read and write French. It is also used by senior students of the Elementary School and is offered as an evening course by Adult

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Education (see Note 1).

4.00 The High School "Math Club" arrives to take a course in introductory Data Processing (see Note 1).

5.00 The Duty Proctor transfers the afternoon's student performance recordings to Edmonton and calls up the courseware for the evening.

6.00 Authoring Time - the next two hours are available to instructors who are creating their own C.A.I. courses (see Note 2).

1. The instructor from the School of Dental Therapy is making some revisions to his course based on observations of the day's lesson.
2. A teacher from the Elementary School and an instructor at A.V.T.C. are working together on a series of graduated drills in English as a Second Language.
3. An adult education instructor is working with a local informant to produce phonological drills in the Chipewyan language.

8.00 Three teachers from the Elementary School are taking CARE-1 as an evening credit course. At the same time, a group of students from Rae-Edzo, in Fort Smith for a cross-country ski meet, are touring the C.A.I. Centre and will use a special 'demo' program at the remaining terminals.

9.00 The Duty Proctor transfers the evening's student performance recordings and the courseware programmed that evening by the authors to the central computer. Requests for overnight batch jobs requiring print-outs in the morning are also sent in at this time.

9.30 The Duty Proctor shuts down the system and locks up.

Well, that was quite a strenuous day! Perhaps more crowded than would actually occur. But this, nonetheless, illustrates the breadth and range of C.A.I. activities that could occur in the N.W.T. in just a few years.

NOTES

1. These courses, and many others, are already operational on the DERS 1500 C.A.I. system, and would be available on the proposed largescale system. In addition, any courses developed at any of the remote sites during the project would be available at all the other remote sites.
2. The DERS proposal suggests that, "An agreement be reached with cooperating institutions, to establish residency periods at the University of Alberta. It is proposed that such institutions give training leaves to their staff. Such persons would become resident with the C.A.I. facility for purposes of carrying out a defined project of course development of interest to the sponsoring institution,..." (Hunka: p.83).
   "The cost of residencies is expected to be shared by participating institutions and the C.A.I. facility..... As a pool of trained staff increased, they could then train others at their remote terminal locations." (Hunka: p.99)
   The proposal suggests that these residencies be for periods of up to three and a half months, and that they could be during the summer.

REFERENCE

Hunka, S.M. and E.W. Romaniuk: A RESEARCH AND DEVELOPMENT PROPOSAL FOR THE ESTABLISHMENT OF A COMPUTER-ASSISTED INSTRUCTION FACILITY, Division of Educational Research Services, The University of Alberta, 1974.